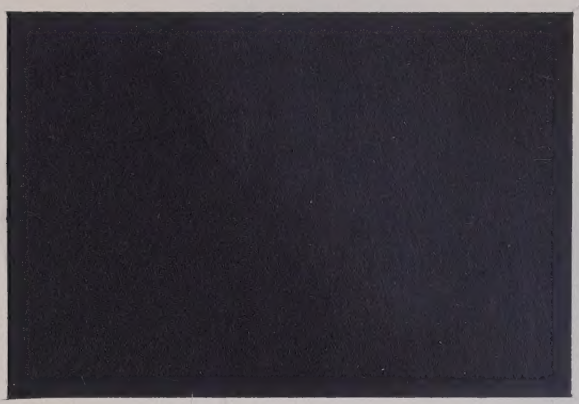
PI

Physik
Instrumente

OPERATING MANUAL

P-263

Das PI System



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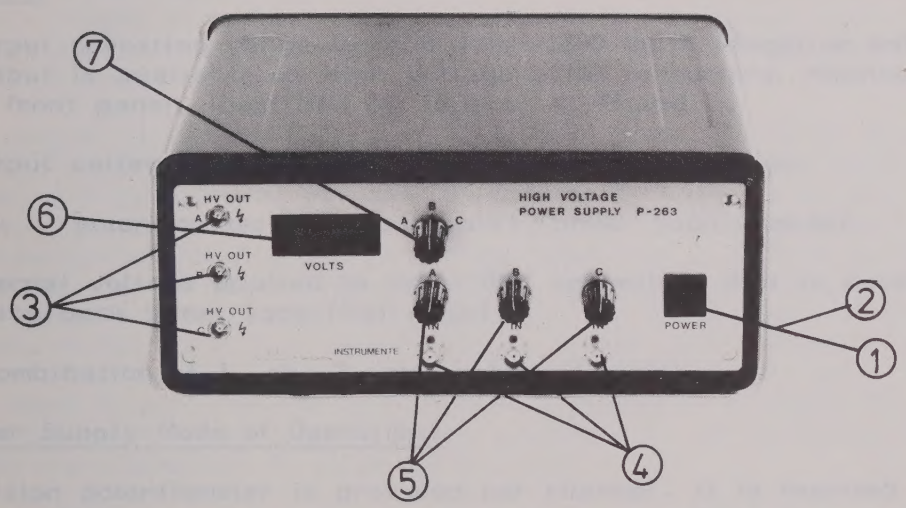
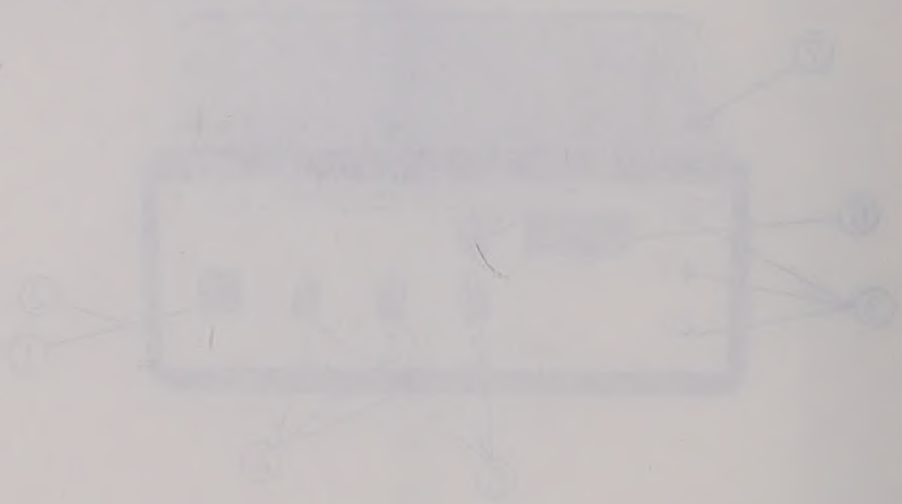
OPERATING MANUAL

P-263



Faceplate

1 Power on and off switch
2 Control lamp
3 3 LEMO High Voltage outputs
4 3 BNC connectors for analogue input
5 3 potentiometers for output control
6 3 1/2 Digit LED-Volt-Meter
7 Channel selector switch for voltage display



INSTRUCTION MANUAL:

P-263 HIGH VOLTAGE AMPLIFIER/HIGH VOLTAGE POWER SUPPLY

Introduction:

The P-263 Electronic Controller is a precision, 3 channel High Voltage Amplifier/High Voltage Power Supply combination, that was designed to be used with devices that require negative high voltage inputs, such as piezo-ceramic actuators, pockel cells and similar devices with high input impedance.

The instrument contains 3 individual channels that are identical in their characteristics and a 3 1/2 digit display module with a channel select switch, that allows monitoring the average value of the output voltage of any of the 3 channels. In the following, the functioning and characteristics of one of these 3 channels is described.

Operation:

The output operating range is from 0 to -1500 Volts (negative polarity). The output is available on High Voltage LEMO connectors, mounted on the front panel, identified by letters, A, B and C.

The output voltage may be set in one of 3 different ways:

1. With potentiometer on front panel (power supply mode).

2. External voltage applied to input BNC connector, that is mounted on the back panel (amplifier mode).

3. A combination of 1. and 2. above (mixed mode).

1. Power Supply Mode of Operation:

A precision potentiometer is provided per channel. It is mounted directly above the BNC input connector on the front panel. When the potentiometer is turned fully counter clockwise, the output voltage is zero. When the potentiometer is set at its opposite limit - fully cw - the output voltage reaches the maximum voltage that can be set manually - in the power supply mode of operation. This value is approximately -1050 Volt, limited by an internal trim potentiometer. This internal voltage limitation only concerns the front panel potentiometer. With the external input voltage the HV-voltages rise up to -1500 Volts in every case. Take into account the limited operating range of input voltage for the connected piezo-translator.

In this first, power supply mode of operation it is assumed that the voltage at the input end (BNC connector on front panel) is zero. Short circuiting the appropriate BNC connector is only necessary - in order to achieve the zero volt condition at the input - in circumstances of exceptionally large electromagnetic interference (EMI) or pickup.

2. Amplifier Mode of Operation :

In general, the voltage gain of the high voltage amplifier is adjusted during manufacture to produce full output voltage for 10 Volts input. In other words, the standard output of -1500 Volt requires a voltage gain of -150X.

Amplifier input impedance is 100K ohms. Input voltage range is restricted between 0 and 10 Volt (positive). In the P-263 units with a maximum output voltage of -1500 Volts, the output quickly becomes non-linear when the input voltage is increased past +10 Volts. As one increases the input voltage beyond 10 Volts, the output can be increased to beyond -1600 Volts, however, in a non-linear fashion.

The amplifier mode of operation allows the following type of functionings for this instrument:

A. Manual remote control. An extension cord with a BNC connector on one end and a variable voltage source (0-10 Volts) at the other end can for example serve this purpose. The high voltage output of the P-263 maybe controlled manually from a distance of many meters if coaxial cable is used as an extension cord. These extension cords are available at customer specified lengths as special orders.

B. AC Signal amplifier. Amplitude of signals from a function generator maybe amplified by a P-263 when used in the amplifier mode to make a piezo ceramic actuator to change its length, for example in a periodic fashion as indicated by the function generator. The bandwidth of the P-263 High Voltage Amplifier is determined by the capacitance of the load (such as the piezo actuators). Since the current that is available to charge the capacitance of the load, is not more than approximately 1,8 mA per channel maximum, the bandwidth of the amplifier with a P-170 piezo actuator, used as load (5 µm extension per 1000 Volts applied) is about 20 Hz; the bandwidth with a P-171 piezo actuator (10 µm extension per 1000 Volts applied) is about 10 Hz, etc.

C. High Voltage Amplifier in a closed control loop. In electro-mechanical control loops, it is sometimes necessary to convert the corrector voltage, which may be the output of a specific control circuit (in the order of a few volts) into a small linear mechanical movement - such as can be produced by a piezo-ceramic actuator. A P-263, when operated in the amplifier mode maybe an ideal and low cost solution to the problem of converting the corrector voltage of a few volts into hundreds of volts, to be applied to the piezo-actuator. In fact, one P-263 maybe used in up to 3 independent control loops. Variations of output in one channel will not affect outputs in the other two channels.

3. Mixed Mode of Operation:

The high voltage amplifier circuitry is designed to add the effect of the front panel knob setting and the voltage applied at the input BNC connector linearly, to produce the composite effect amplified by the voltage gain. There are useful applications of this mode of operation. In one such case an AC (low frequency) signal that has no DC component is available to drive a piezo stack. In order to translate the full cycle of the AC signal into a mechanical translation, the AC signal needs to be biased. This DC bias maybe set manually on the front panel control. Manual search for the peak of an effect - such as sweeping a single cavity resonance across a gain line of a laser - is made simple when a small AC modulation signal is injected through the input to the amplifier. When the peak is reached manually - the AC component in a monitor signal goes to zero, while the 2nd harmonic becomes a maximum.

Turning the Instrument on.....

The P-263 is designed to operate at 220 or 110 Vac at 50/60 Hz. The voltage can be switched over by turning the fuse holder.

The powerswitch of the instrument is an alternate action push button on the front panel. A built in LED indicates the state of this powerswitch, i.e., whether it's off or on. But this only happens when the instrument is plugged in. So, therefore, before anything is connected to the P-263, especially to its output LEMO connectors, plug the instrument in and ascertain that the powerswitch is off. (LED pilot light is off.)

It is recommended to get acquainted with the P-263 before connecting it to other components. There are potentially hazardoes voltages that are available at the connectors, when the instrument is on, therefore carefully review the connections before turning the power on.

Turn the power on. - Ascertain that the LED is lit. - Turn all 3 front panel knobs to counter clockwise. - Examine the voltages at the output by viewing the 3 1/2 digit voltmeter display by switching the channel select switch from channel A to B and then to C.

Voltages should be 000 +/- 2 Volts. Switch channel select switch to "A". - Turning the left most knob (channel "A") clockwise, will increase the display reading in a linear fashion from 000 to past -1500 Volts.

Switch channel select, switch next to "B", - by using the middle knob, increase the output voltage from 000 to the maximum.

Try setting a certain voltage value, such as -1000 Volts. - Keep it at this value for a period of time, - as the instrument warms up, notice a decay of 2-3 volts of this value over a period of maybe 5 minutes. Once the equilibrium temperature is reached, the output voltage value stays constant.

Try adjusting the knob of channel "C" while observing the voltage on channel "B" via the 3 1/2 digit display. - Adjusting the knob of another channel should have no effect on the output voltage value of the observed channel.

Connect a piezo actuator to the LEMO connector of the channel, output voltage value of which is being observed by the display. The displayed value should not change more than one digit.

In fact, it is unlikely that it will change at all. If it does, then it means that either the connecting cable or one of the 2 connectors on either end - or the piezo actuator itself, is malfunctioning. In this unlikely case, the cable and the piezo actuator needs to be checked out with an ohm meter. Resistance should not be measurable - in any case it should be higher than 1000 Magaohms. Do the same loading test also for the other two channels.

Frequency behaviour

When the output current is less 1,8 mA per channel, a feedback circuit controls the voltage at the point behind the 100 Kohms output resistor. In this case the output impedance is 100 Kohms. When the output currect exceeds the 1,8 mA, the impedance increases up to 820 Kohms.

Due to the capacity of piezo-translator (from 10 to 100 nanofarad), a displacement current arises, when operating with AC-voltage. The internal resistance of P-263 limits the voltage rise time.

To calculate the cut-off frequencies for different capacitiv loads cp, the following formular can be used:

Voltage rise time t1:

$t1 = 100\ \text{Kohm}\ (cp + 3.3) \cdot 10^{-9}$

Voltage slope time t2:

$t2 = 820\ \text{Kohm}\ (cp + 3.3) \cdot 10^{-9}$

With cp is the load capacity in nF.

For example, a load capacity of 20 nF leads to a rise time of 2,3 a slope time of 19 ms and a cut off frequency of 47 Hz.

Internal Adjustment Capability

Limitation of regulating range of front panel potentiometer

With the three front panel potentiometers the output voltage can be regulated within the range of 0 V and an upper voltage level, adjustable internally.

The P-263 will be delivered with an internal voltage adjustment of -1050 V. Without any problems the voltage can be adjusted up to -1500 Volt.

NOTE: The internal voltage limitation only concerns the front panel potentiometers. With external regulating voltage the HV-output can fall down to -1500 V or more.

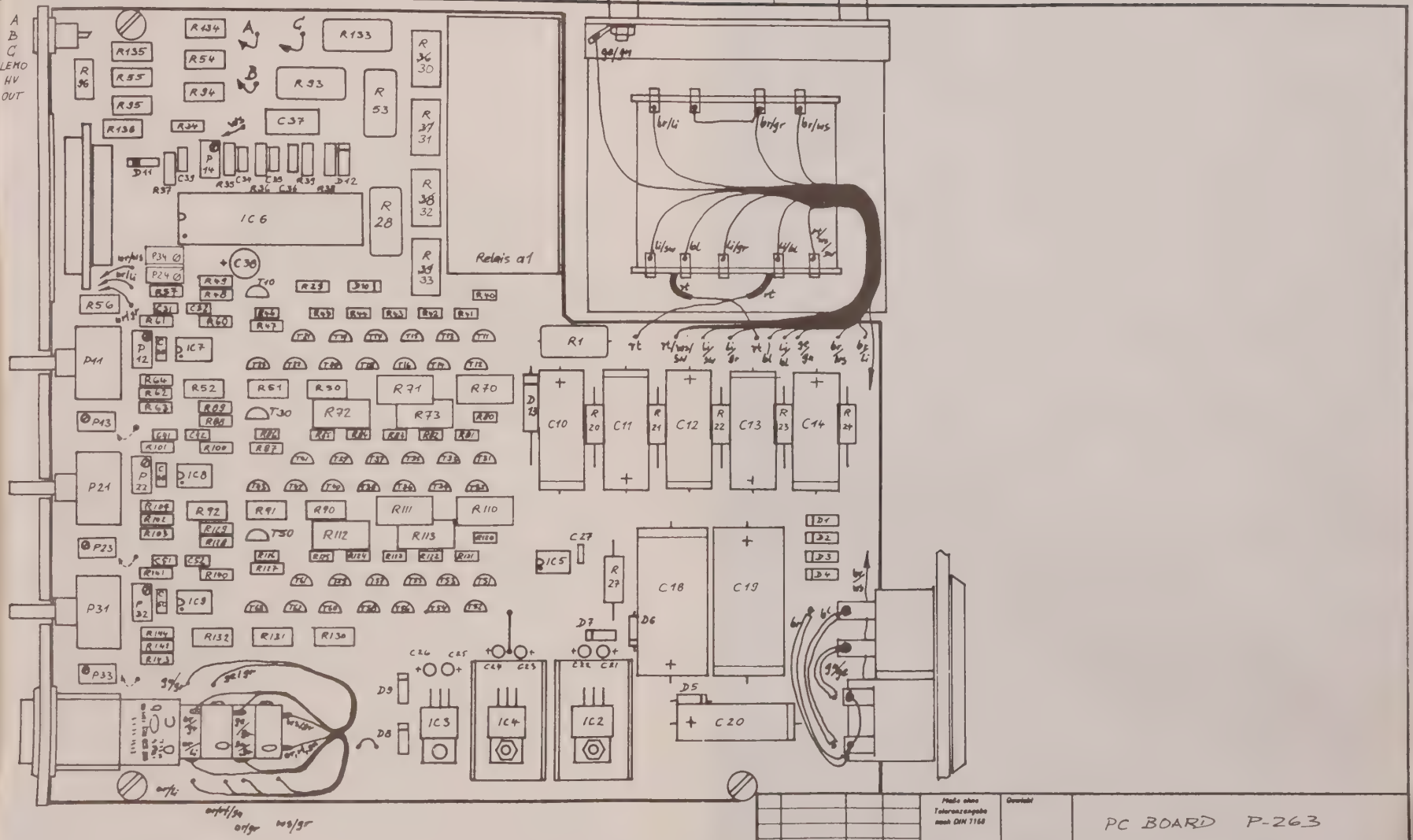
Be sure that the maximum output voltage is within the voltage range of the connected piezo-translator.

How to adjust the P-263

Switch off the line voltage and remove the upper casing. Compare the circuit board with the sketch on the next page. Beside the main potentiometer P11, P21 and P31 you see trimpotentiometer P12, P22 and P32. With these trimpotis the maximum output voltage of the main-potentiometer can be limited.

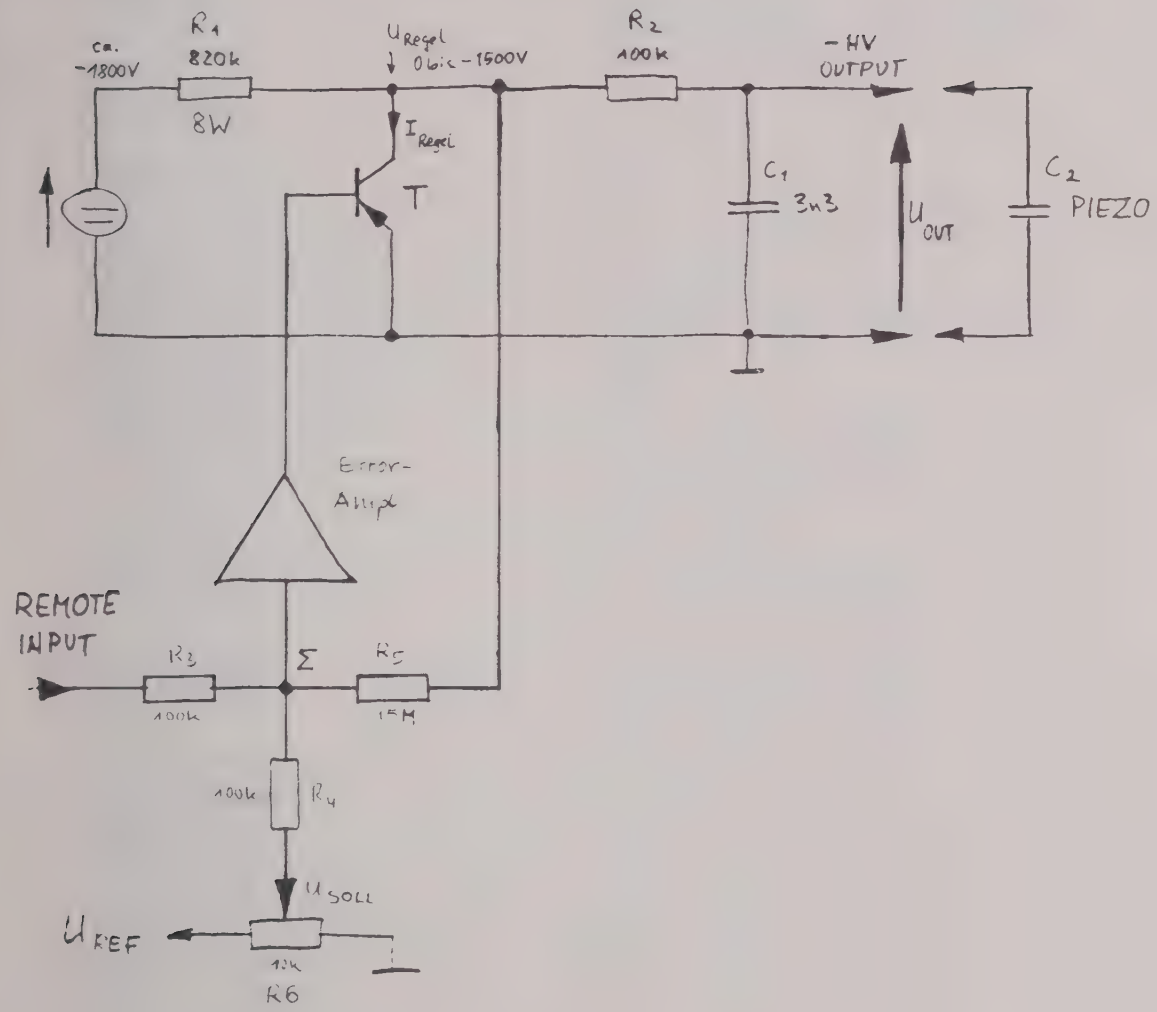
For adjustment, switch on the P-263, turn the three front panel potentiometers clockwise to maximum and then adjust with the trimpoti the max. output voltage. Turn the display select switch to this channel, you are going to adjust.

WARNING: Do not touch any piece on the board with your hand, when the P-263 is on. For adjustment use a screwdriver with a plastic grip.



Maße ohne Toleranzangabe nach DIN 7168		Oberfläche	PC BOARD P-263		
		Tag	Name		Maßstab
Gez.		9.9.82		08 0263 100	
Gepr.					
Norm					
Polytec Ges. für Analysen-, Meß- u. Regeltechnik m. b. H. & Co.				Zeichnung-Nr. 08 0263 300	
Ausgabe	Änderung	Tag	Name		

Prinzipschaltplan zum P-263

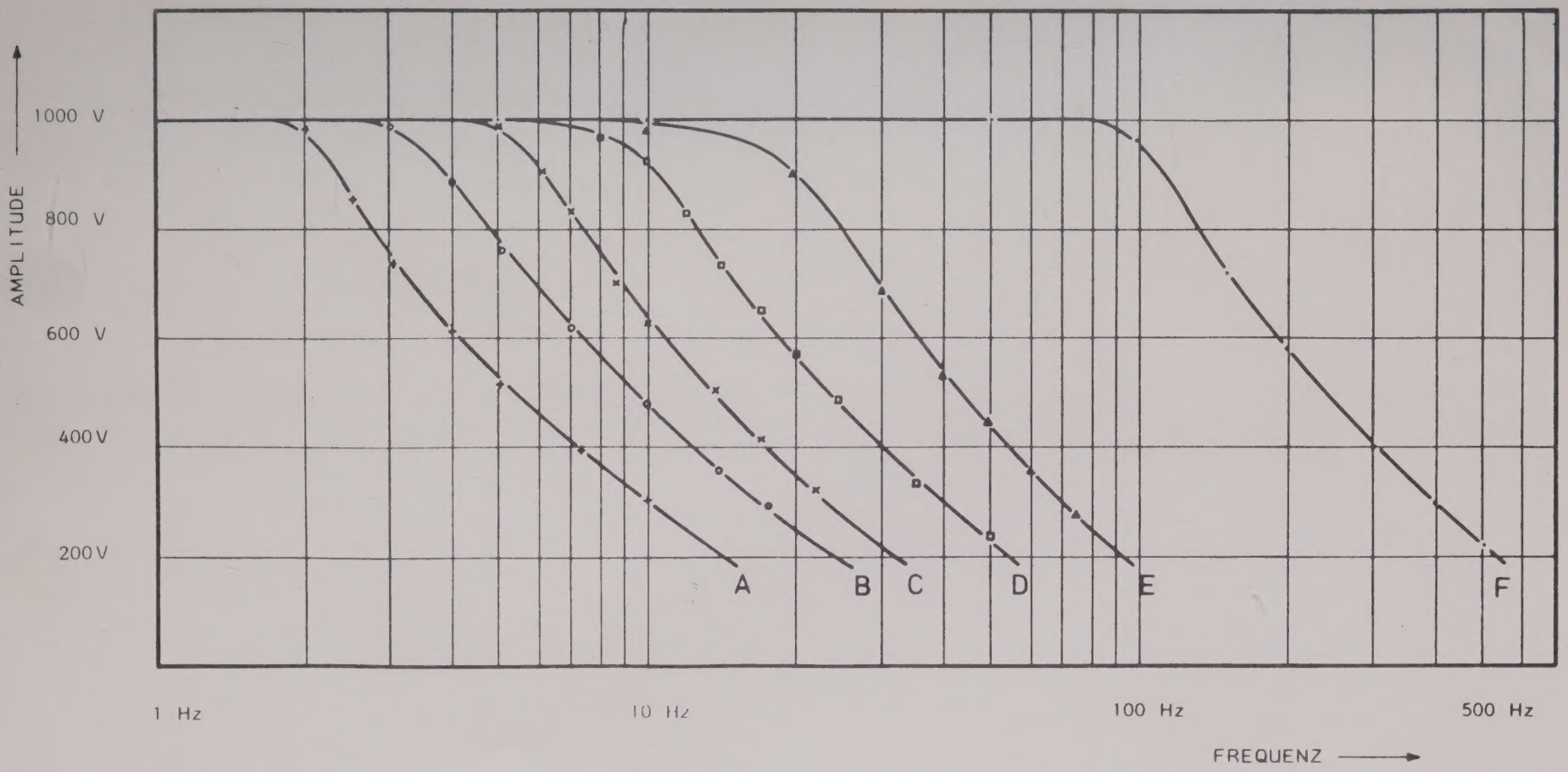


Technical Data

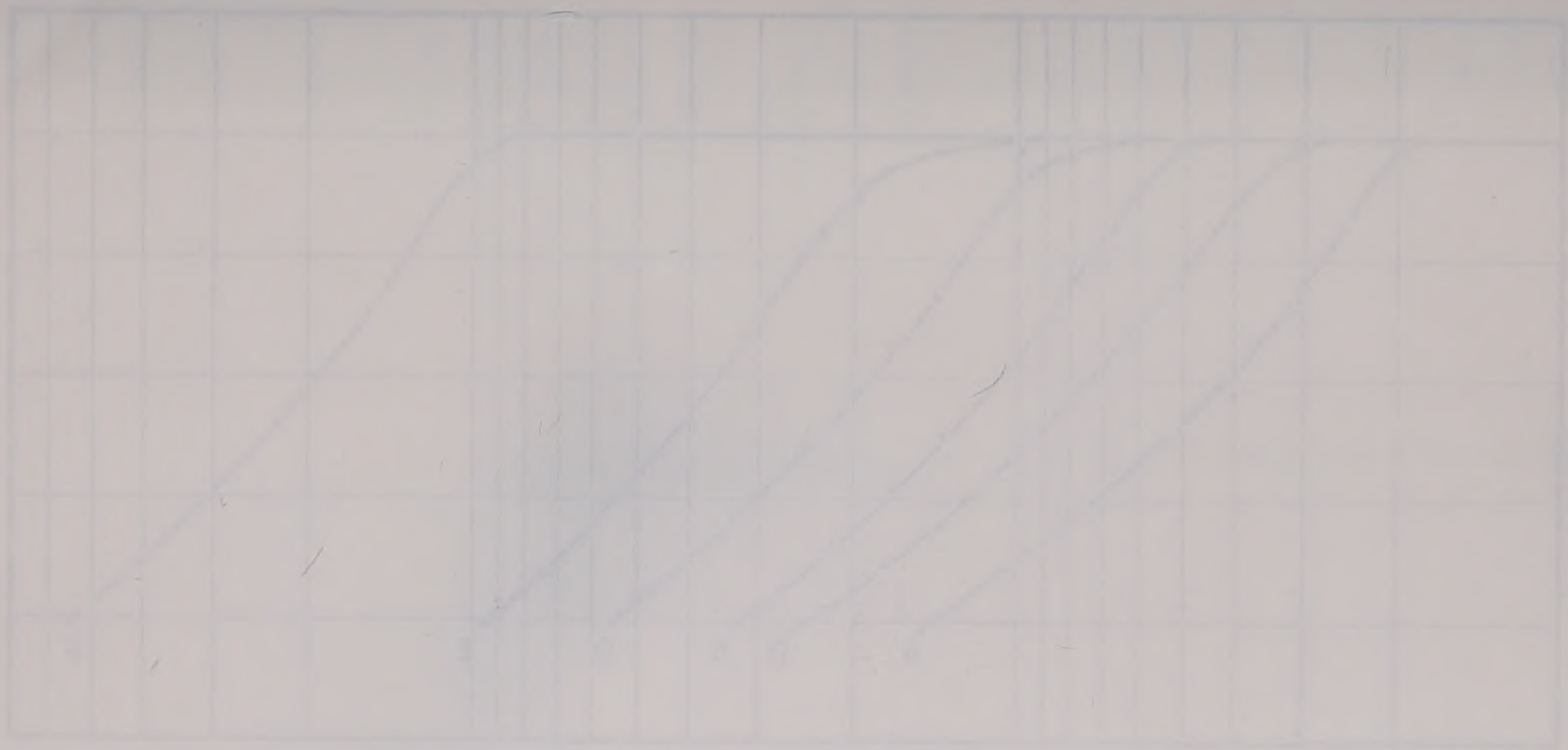
P-263 High Voltage Power Supply/Amplifier

Operations:	3 independent functional High Voltage output and low voltage input channels.
Output Voltage:	0 to -1500 V
Output Polarity:	negative
Output Regulation:	manually or by input voltage
Output Impedance:	100 KΩ within regulating range 920 KΩ out of regulating range
max. Output current:	1,8 mA
Voltage rise time:	0,3 ms (with ohm load) 1,3 ms (with 10 nF) 4,3 ms (with 40 nF)
Voltage slope time:	2.7 ms (with ohm load) 11 ms (with 10 nF) 36 ms (with 40 nF)
Bandwidth:	360 Hz (with ohm load) 80 Hz (with 10 nF) 22 Hz (with 40 nF)
Input Voltage:	0 to +10 V
Amplification factor:	-150
Linearity of Amplification:	better than 1 %
RMS:	better than 1 V
Long time stability:	better than 1 V
Digital Voltage Indicator:	3 1/2 digits with 3-channel selector switch
Power Supply:	110 V +/- 10 % or 220 V +/- 10 %
Dimensions:	110 x 260 mm, 280 mm deep
Weight:	4,4 kg
Fuse:	0,5 A (220 V) 1 A (110 V)

FREQUENZVERHALTEN P-263



A: P-174 (103 nF)
B: P-173 (80 nF)
C: P-172 (37,5 nF)
D: P-171 (20,7 nF)
E: P-170 (14,6 nF)
F: ohmsche Last



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Fertigungs- und Lieferprogramm

Optische Bänke und Zubehör
(Produktgruppe XZ)
Schienensystem mit 4 verschiedenen, untereinander kombinierbaren Schienenprofilen, Verbindungsteilen, Reitern, Reitersäulen, Stiften, Halterungen

Schwingungsisolatoren, Tisch- und Gestellsysteme
(Produktgruppe TS)
Pneumatische Rollbalgisolatoren, Kleinisolatoren, Stahlfederisolatoren, Labortische, Niveauregulierung, modulare Rohrgestellunterbauten, Honeycomb- und Kunststein-Tischplatten

Mikropositionierungen
(Produktgruppe MP)
Linearverstellungen (XYZ) bis 800 mm Verstellweg, Präzisionsversteller, Drehversteller, Kippversteller, Feinstellschrauben

Motorantriebe
(Produktgruppe MS)
Schrittmotorantriebe mit Steuerungen, Rechnerinterface, Anwendersoftware, Gleichstrommotore mit Steuergeräten

Piezoelektrische Translatoren
(Produktgruppe PZ)
Piezoelemente bis 100 μm Längenänderung, Stapelelemente, Streifenelemente, Sonderbauformen, Hochspannungsquellen, Hochspannungsverstärker, digitale Piezostellsysteme

Elektro-optische Komponenten
(Produktgruppe AM)
He-Ne-Laser, Strahlaufweitsysteme, Raumfilter, akusto-optische Modulatoren und Deflektoren

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